WOOD WASTE ENERGY RECOVERY SYSTEMS

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As preface to my formal remarks, I, representing Energex, Ltd., would like to express my pleasure and appreciation for the opportunity to address your meeting. Two years ago we came to the Redding Area from San Diego and shared equipment ideas with the Shasta County Forest Council and received fine guidance to pursue solutions to your problems. Over the past two years Energex has installed six Vortex Wood Burners and owes much to the encouragement of the Council and, if I may say, Messrs. Milt Schultz - Paul Bunyon Mill, Bob Guth - Kimberly Clark, and Art Lull - U. S. Plywood.

May I quote now from a recent Forest Products Journal:

> "Every part of our operations must be examined for the opportunity to cut costs. Goals and procedures must be redefined and revised for maximum efficiency. Wood waste from logging residue and bark, slabs, cutoffs, and sawdust must be put to use."

Cutting costs, utilizing wastes and meeting the ever increasing requirements of environmental control must play an important role in your future business plans. In this brief period, I would like to share some ideas on wood waste energy recovery systems. Certain trends in the industry encourage the use of wood waste as an energy source; they are:

- A growing shortage and partial inavailability of gas and oil.
- A continued rise in oil and gas costs.
- More complex problems of residue disposal.
- More stringent air and water pollution laws.
- Reduced net profit from residue sales.
- A growing demand for energy in your operations.

Proper wood waste management can turn what now is a liability into a substantial asset.

Let us speak first of pollution and its sources. Bark and sawdust usually are destroyed in teepee burners or used as boiler fuel. Without proper controls these devices may have stack emissions in excess of the smoke and particulate codes. These two sources are now the primary targets for compliance and enforcement. Hauling wastes to land-fill areas will become too costly and may come under the scrutiny of water quality enforcement agencies.

Environmentalists and regulatory agencies are devoting their major attention to visual emissions, however, as better measurement techniques become available, particulate emissions will be of equal air quality concern and enforcement.

Justifiably, the lumberman has been reluctant to expend capital dollars to meet the existing or future codes as there was no economic return - unless he was close to operations shut-down or heavy financial penalties. The use of wood wastes was not attractive, as purchased fuel was relatively inexpensive, available and a strong market for wastes existed outside his operations. The past few years have seen fuel costs rise to rates of 10-20 percent per year; periodic fuel interruption occurred. Labor costs to handle wood waste rose, coupled with a lessened market demand, resulted in a decline of net profit on the outside sale of wastes.

A study of the forest products industry, its needs, problems and potential, points to the development of systems to internally utilize wood wastes and also meet current and anticipated pollution codes. System suppliers must carefully analyze the key components necessary to perform the conversion of wood wastes into clean heat energy including the equipment necessary to handle, store, prepare and use this energy resource.

Let us proceed by exploring typical waste availability in your operations, offer some examples of wastewood economics and discuss the mechanisms of clean burning.

Wood residues vary for each mill; however, some "Rules of Thumb" indicate that for each 100,000 board feet cut and kiln dried, 250,000 lbs. of waste are generated. The residue breakdown is as follows:

	DRY/LBS.	WET/LBS.
Bark	53,000	105,000
Sawdust	47,000	95,000
Planer Shavings	40,000	50,000
	140,000/lbs.	250,000/lbs.

Typical heat available from dry wood is 8000 BTU's per lb. Therefore, waste accumulations per 100,000 Bd. Ft. equal: 140,000 lbs. x 8000 BTU/lb., or 1,120,000,000 BTU's per day. Assuming 6000 BTU requirement to kiln dry a board foot, it can be determined that typical dry waste available can dry approximately 180,000 Bd. ft. per day (1,120,000,000 BTU's available ÷ 6000 BTU's per Bd. Ft. = 180,000 Bd. Ft.).

Costs of direct firing dry kilns using purchased energy will average \$.50 - \$.70 per million BTU's. Daily purchased energy replacement savings would be \$560 to \$785 per day. (1,120,000,000 BTU \$.50/mm BTU = \$560). Projected savings over time typically pay off Energy Recovery Systems in less than three years. We have briefly examined the availability of wastes, their heat energy economics and now must understand how clean burning is accomplished.

Wood or any other combustible material must pass through several steps to attain complete combustion. The first step is driving off the contained water in the wood. Next, the volatile gases, resins or other nonsolid materials are released and burned, leaving the fixed carbon or char, the most difficult combustion problem. Time needed for wood pyrolysis is under study by many forest research laboratories and these results will assist in the design of even more efficient burning devices. However, recent tests on Energex Burners have documented a combustion completeness in excess of 99.7%. It is well known that smaller wood particles burn more rapidly than larger pieces, because there is greater wood surface to volume exposed to combustion air. A pound of sanderdust burns at a very different rate than a pound of chips.

Fuel preparation is most important to the production of high temperatures and complete combustion of the fixed carbon, to prevent flyash or high particulate emissions.

As mentioned earlier, water must be evaporated from the wood before the pryolyzing mechanism can begin. The higher the moisture content of the wood, the longer it takes to burn. Wet wastes (50% m.c.) require approximately twice the burning chamber size as is needed to develop the same heat from dry wastes. Often smoke occurs from wet wood firing as the released moisture blankets the burning pile.

We must agree that moisture in wet sawdust or bark has to be removed, the decision is whether it be done external to the boiler or to make the boiler a dryer. While it is less work to evaporate in the boiler, it has been shown that increases of 30-50% in steam output and heat transfer from the same size boiler can be obtained when fired with dry rather than wet fuels and this is for two reasons. First, the boiler passes are not heavily laden with low temperature carrying moisture gases, and secondly, the dampening effect of the moisture does not reduce the temperature available to the boiler tubes for higher heat transfer.

Another important factor that will assist in cleaner combustion is a consistent metering of material to a wood burner. Simple live bottom bins prevent intermittent dumping of fuel that can create a temporary dampening of the fire, resulting in smoke. These principles are well known to manufacturers of combustion equipment. Energex combustion systems employ suspension or vortex burning techniques that insure adequate air mixing to maximize complete particle combustion, all with a burning chamber 1/20th the size of conventional fire boxes. This new burner design has been forest industry tested over the past two years and proven its ability to deliver high, staple temperatures, operate on a fully automatic basis, modulate heat outputs at a 5 to 1 turndown ratio, and, most importantly, when incorporated in energy recovery systems, meet state and local air pollution codes.

Available woodwaste burning systems can be characterized as follows:

<u>Dutch Ovens - Fire Boxes - Cells</u>

. Takes wet wood
. Must be constantly monitored
. High maintenance
. Usually exceeds emission regulations
. Pile burning
. Slow BTU reaction time.

<u>Stokers</u>

. Mechanized fuel loading
. Thin fuel bed promotes more rapid burning
. Accepts wet hogged fuel.

<u>Ignitor/Secondary Combustion Systems</u>

. Accepts small sized moderately (20%) wet fuel
. Ignition started in primary combustion chamber
. Burn-out completed in large secondary chamber
. Relatively clean burning
. Continuous natural gas and oil for ignition

<u>Energex Burners</u>

. Completes combustion in 1/20th chamber volume
. Self-sustained combustion
. Immediate BTU output changeability
. Does not require secondary combustion chamber
. Accepts small sized dry fuels.

In Summary

The following are key points to consider when your evaluation of Energy Recovery Systems begins:

1. Determine your average and peak steam or BTU requirement.
2. Carefully detail the volume and moisture content of available residues.
3. Compare present and future purchased energy costs against income now being received from the sale of dry wastes and costs for disposal of wet residues.

4. Compare energy recovery equipment for:
   a) Space required to deliver the same BTU's.
   b) Fuel preparation necessary.
   c) Ability to modulate rapidly and conserve waste fuel.
   d) Safety devices and controls.
   e) Proven performance in meeting air quality laws present and future.
   f) Mill-down time needed for erection and installation.
   g) Lastly, cost.
5. Review current tax and depreciation incentives for energy recovery and pollution control facilities.
6. Evaluate suppliers reputation, technical competence and stability.

Select the system to meet your needs; to increase steam output in existing boilers; reduce emissions from existing boilers; directly heat dry kilns and other dryers replacing natural gas, propane, etc. and reduce hauling costs of residues.

Wood waste management and utilization, compliance with pollution laws, the ability to use existing heat consuming and storage equipments -- matching these with new waste burners is no simple task. The staffs of Energex, Ltd. and suppliers of energy recovery systems are devoting full effort to assist the forest products industry in waste management and utilization to return clean energy economically from what is now a liability.